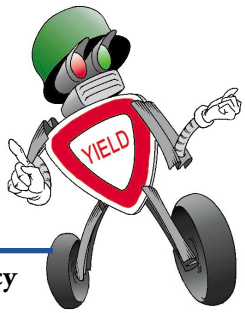
Traffic Engineering & Highway Safety Bulletin



Military Traffic Management Command Transportation Engineering Agency
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January 2002

Roadside Safety
A Forgiving Roadside

Did You Know...

When a roadside hazard, such as a tree or utility pole, is in the clear zone (refer to the January 2001 *Traffic Engineering & Highway Safety Bulletin*), there are five options to mitigate the hazard. These options (Figure 1) should be considered in the following order:

Option 1: **Remove** the hazard

Option 2: **Relocate** the hazard (outside the clear zone)

Option 3: **Reduce** the impact severity (ex. breakaway support)

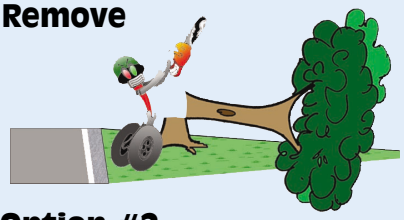
Option 4: **Shield** the hazard with a traffic barrier (guardrail)

Option 5: **Delineate** the hazard with an object marker.

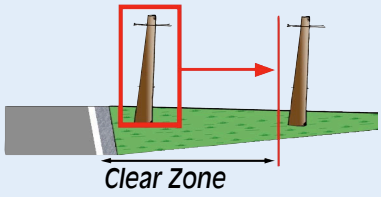
In This Issue:

Figure 1 - Options to Mitigate the Hazard

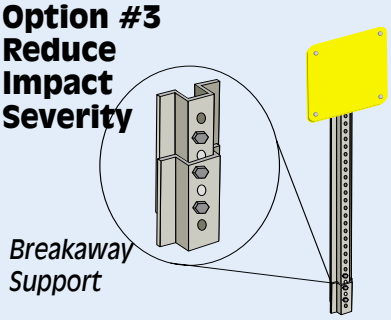
Option #1 Remove



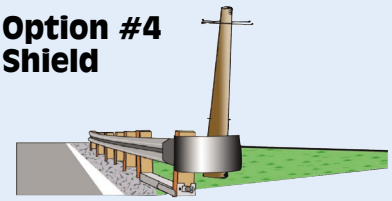
Option #2 Relocate



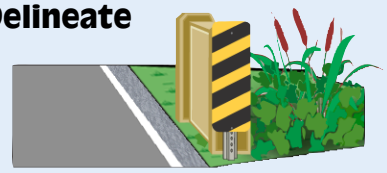
Option #3 Reduce Impact Severity



Option #4 Shield



Option #5 Delineate



Roadway Shoulders

Adapted from a *Moving Forward* article published by the Pennsylvania Local Roads Program.

Too often, improper shoulder maintenance leads to crashes. The story is common: a car's wheels drop off the edge of the pavement of a highway; the driver attempts to bring the vehicle back into the travel lane, but the rear wheel catches the shoulder drop-off; the driver over steers and the vehicle swings into the opposing lane of traffic. Usually this situation can be avoided by controlling shoulder erosion.

Roadway shoulder maintenance should include:

Erosion control

Proper construction and grading of shoulders and road edges is critical for controlling erosion. Proper construction will provide lateral support for the shoulder and prevent the edges from cracking and eroding. Proper grading allows water to flow from the roadway and into the drainage system, rather than standing and eroding the shoulder or pavement edge.

Removal of build-up

Remove vegetation and dirt build-up along roadway shoulders and edges to expedite the drainage of water from the roadway surface.

Control of shoulder cracking

Apply a seal coat to the roadway shoulders to control cracking and assist in maintaining its structural integrity.

Breakaway Supports—The Basics

Removing or relocating a roadside hazard from the clear zone is not always feasible. Some objects must be mounted near the roadway, and some objects may have been mounted close to the roadway long before the clear zone concept was considered. Man-made objects such as signs, mailboxes, light poles, utility poles, bollards, etc., are often mounted within the clear zone.

One-third of motor vehicle deaths involve vehicles leaving the roadway and hitting fixed objects. In cases where these objects cannot be removed or relocated, using an appropriate breakaway support will reduce the impact severity.

A *breakaway support* (Figure 2) refers to all types of devices that yield when hit by a vehicle. They yield because the design of the support purposely incorporates a *weak* spot. Two criteria dictate that these supports *fail in a predictable manner*:

- AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*

  (To order, see page 6 for Web address.)

- *National Cooperative Highway Research Program (NCHRP) Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features*

  (To learn more, see page 6 for Web address.)

While it is not important to memorize these publications, it is critical to understand that strict specifications exist for the performance of breakaway supports. Since most states have a standard design for breakaway supports that have been crash tested and approved, consult your state's standards for an appropriate design.

Breakaway supports are available for objects such as:

- Postmounted signs
- Luminaires
- Traffic signals
- Fire hydrants
- Mailboxes
- Utility poles

Give special care and consideration to breakaway supports for luminaires, traffic signals, and utility poles.

If not designed or constructed properly, a falling support can be hazardous to other vehicles on the roadway.

Safe Drainage Design

Many of the drainage structures on military installations were installed before roadside safety was considered an important topic. Common drainage feature deficiencies are shown in Figure 3.

Figure 2 - Breakaway Supports

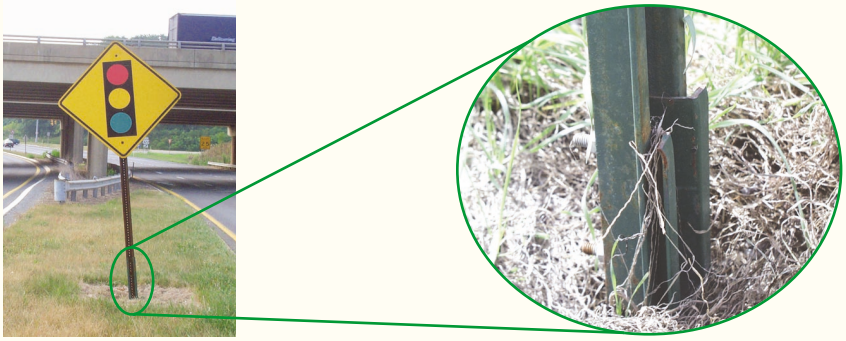


Figure 3 - Common Deficiency Examples

Example 1: Protruding endwalls for cross-drainage structure

Example 2: Endwalls too close to roadway edge for cross-drainage structures

Example 3: Parallel-drainage ditches within the clear zone

Minimizing the impact on safety

Two types of drainage structures exist along roadways, cross-drainage structures and parallel-drainage structures. Cross-drainage structures are designed to carry water underneath the roadway, while parallel-drainage structures are designed to carry water parallel to the roadway.

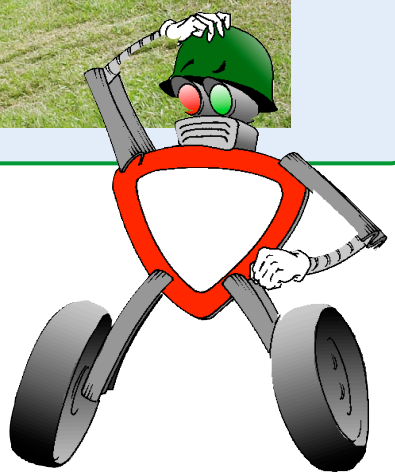
Cross-drainage structures

For cross-drainage structures, consider the following options to minimize their impact on safety:

- **Use a traversable slope**—For smaller diameter culverts (40″ or less), the end of the culvert should match the slope of the surrounding embankment. This design can be accomplished with the use of end sections or wingwalls (Figure 4). For larger culverts (greater than 40″ in diameter), consider treatments such as extending, shielding, or delineating the structure.

What's Wrong With This Photograph??

Answers on Page 5



- **Extend the structure** so it is less likely to be hit—If the end of a culvert cannot be made traversable, it should be extended beyond the clear zone.
- **Shield the structure**—Sometimes a structure cannot be made traversable or extended beyond the clear zone. This is especially true for larger structures. In those cases, consider installing a barrier such as guardrail.
- **Delineate the structure**—If the above alternatives are not appropriate, the structure should be delineated as shown in Figure 5.

Figure 4 - Culvert with End Section

Figure 5 - Delineate the Structure

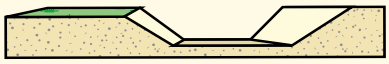
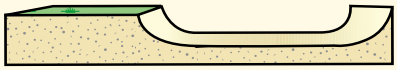
Parallel-drainage structures

For parallel-drainage structures, the following options should be considered to minimize their impact on safety:

- **Eliminate the structure**—In some cases parallel-drainage structures can be eliminated. For example, at a cross-road, the water can be carried over the cross street rather than underneath it (Figure 6).

Figure 6 - Eliminate Parallel-Drainage Structures

Figure 7 - Ditch Designs

Best for Safety		Best for Drainage
	V- Ditch 	
×	Rounded 	
	Flat Bottom 	×
×	Rounded/Flat 	×

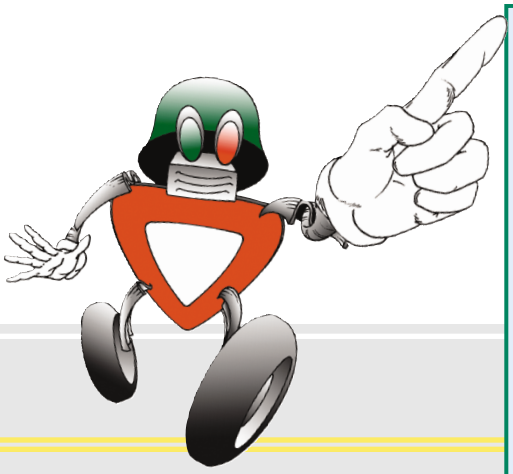
- **Use a traversable design**—Use of a rounded flat-bottom ditch provides the best combination for safety and drainage (Figure 7).
- **Move the structure**—Structures should be moved laterally, preferably to a location outside the clear zone.
- **Shield the structure**—Sometimes a structure cannot be removed or relocated outside the clear zone. This is especially true for large structures. In those cases, consider installing a barrier such as guardrail.
- **Delineate the structure**—If the above alternatives are not appropriate, the structure should be delineated.

Refer to Figure 8 for a summary of drainage feature mitigation measures.

IN THE NEXT ISSUE

Gates - Short-term solutions and rules of thumb:

- ❑ **Overall Capacity**
- ❑ **Lighting**
- ❑ **General Safety Features**



MTMCTEA Can Help!

MTMCTEA highway engineers stand ready to help installations with their traffic engineering concerns—especially those involving high accident locations. We perform many types of studies with an emphasis on low-cost improvements that are immediate or short-term and yield high benefits to their implementation costs.

Generally, the studies conducted include:

- Fatal crash analysis
- Safety audits
- High accident locations
- Access Control
- Traffic engineering
- Traffic impact (such as BRAC)
- Access roads
- Force protection
- Signal operations

Figure 8 - Drainage Feature Mitigation Measures

Type of Drainage Structure	Deficiency	Potential Mitigation Measures
Cross-drainage structure	Non-traversable slope at the end of a culvert (Figure 3, Example 1 & 2)	• Install metal end section (Figure 4) • Install concrete wingwalls • For larger culverts (>40" in diameter), consider extending the culvert or installing barrier
	Protruding headwall (> 4 inches) (Figure 3, Example 1)	• Remove headwall and install end section or wingwalls • Remove the top of the headwall • Regrade the area around the headwall
	Culvert end close to edge of roadway (Figure 3, Example 2)	• Extend the culvert laterally outside the clear zone • If culvert extension is not possible, shield or delineate the end of the culvert
Parallel-drainage structure	Non-traversable parallel ditch (Figure 3, Example 3)	• Convert the drainage system to a "closed" system (i.e., installing pipes and inlets) • If a "closed" system is not feasible, regrade the ditch to a rounded flat-bottom ditch (Figure 7)
	Culvert underneath a cross street within the clear zone (Figure 6, Top Photo)	• Relocate the culvert outside the clear zone • If relocation is not feasible, flatten the slope around the end of the culvert as much as possible. The use of an end section or wingwalls may be necessary.

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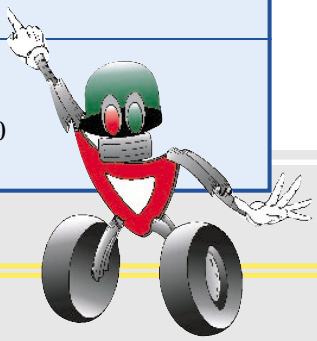

Answer from Page 3

An unnecessary, protruding concrete headwall is located within the clear zone. In this instance, consider removing the headwall and grading a traversable slope. It appears that an inlet has been installed, therefore the headwall serves no purpose.

Reference List

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- NCHRP 350 – http://safety.fhwa.dot.govprograms/roadside_hardware.htm

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